unpatentable over Fujii in view of Kaise, and further in view of Popovich (U.S. Patent No.: 6,678,078), hereinafter referred to as Popovich.

Brief summaries of the new applied references are as follows:

Fujii

The invention of Fujii is directed to a three-dimensional image display device for displaying three-dimensional images which an observer can observe without special glasses. The 3-D image display device has a parallax barrier having a plurality of apertures provided in front of an LCD element. Each aperture is equipped with a color filter of any one of red, green, and blue colors. The LCD element conducts monochromatic display, and hence, no color filters are provided therein. In the LCD element, regarding each color, a pixel group is provided at each position corresponding to the color filter of the color, the pixel group being composed of a plurality of pixels which are driven in response to an image signal corresponding to the color. *See Abstract and col. 1, lines 5-10 of Fujii.* While a known parallax forming device used a series of apertures and lenses, Fujii specifically teaches away from lens array due to their increased costs. Additionally, the quality of 3D display depends on the parallax of multiple image elements, and Fujii seeks to provide parallax elements that are large in number and small in size. Col. 5, lines 27-37.

Kaise

Kaise relates to liquid crystal panels, which have collecting micro-lenses opposing pixel electrodes driving liquid crystal pixels so as to achieve higher luminance, and projection type display devices using such liquid crystal panels. *See Abstract of Kaise.* The focal lens of the

lenses is greater than the array and first display substrate to reduce a divergence angle. The light collected by each lens is focused inside the substrate.

Further, Kaise intends to achieve higher luminance of the transmitted light beam on the liquid crystal display device with micro-lenses ML; in the disclosed liquid crystal display device, the parallel white light 11 preliminarily color-separated into light beams of B, R, and G by the dichroic mirrors 12B, 12R and 12 G enters the LCD panel 20 having no color filters, where the LCD panel 20 is used merely as a shutter to block or transmit the entered respective color-separated light beams of RGB.

Popovich

Popovich relates to a solid state filter used in sequentially illuminating an image display, directly or indirectly, with first, second, and third bandwidth light. The solid state filter includes a hologram that is switchable between active and inactive states. While in the active state, the hologram diffracts a first bandwidth light. In contrast, the switchable hologram transmits the first bandwidth light without substantial alteration when operating in the inactive state. In one embodiment, the diffracted first bandwidth light is used to illuminate a monochrome image presented on a display device. In another embodiment, the transmitted first bandwidth light is used to illuminate the monochrome image presented on the image display. *See Abstract.*

§ 103(a) Rejections(Fujii / Kaise) - Claims 1, 2, 17, and 19

Claims 1, 2 17 and 19 are rejected for the reasons set forth on pages 2-3 of the present Office Action. Applicant traverses these rejections at least based on the following reasons.

With respect to claim 1, the Examiner acknowledges that Fujii does not disclose displaying the monochromatic image having a higher gradation resolution than reproduction performance of each of the R, G and B cells in the color display device.

In an effort to further describe Fujii and distinguish the present claimed invention over Fujii, Applicant submits that the new reference of Fujii discloses a 3-D image display device comprising an LCD element 1 for displaying a monochromatic image and an optical path controlling member provided in front of the LCD element 1 at a predetermined distance therefrom, e.g., a parallax barrier 21 in which a plurality of apertures 23 and light blocking members 24 are arranged alternately and regularly, or a lenticular lens 41 in which a plurality of cylindrical lenses 42 are arrayed. The apertures 23 in the parallax barrier 21 are respectively provided with a red color filter 25R, a green color filter 25G, and a blue color filter 25G in order, and the cylindrical lenses 42 on the lenticular lens 41 are respectively provided with a red color filter 44R, a green color filter 44G, and a blue color filter 44 B in order, resulting in the arrangement where each of these color filters (25R, 25G, and 25B or 44R, 44G, and 44B) corresponds to at least two pixel groups on the LCD element 1. That is, at least two adjacent LCD elements 1 correspond to a single color filter.

In other words, the 3-D image display device disclosed in Fujii displays a 3-D color image by utilizing the combination of the LCD element 1 for displaying a monochromatic image that is not provided with color filters and the optical path controlling member that is provided with color filters and arranged at a predetermined distance from the LCD element 1, wherein at least two pixel groups on the LCD element correspond to each of the color filters.

On the other hand, the present invention, for example, can display a monochromatic image on a color display device having ordinary R, G, and B color filters on which a unit pixel p is composed of three pixels of R, G and B, which can be represented respectively by pl, p2, and p3. *See discussion of claim 10 in the next section, for example.* Differently from the 3-D display device of Fujii, the present invention does not use an LCD element 1 for displaying a monochromatic image provided with no color filter, nor does the present invention display a color image.

Conventionally, when displaying a monochromatic image on a color display device, the display is a gray display so that an identical image data is sent to each of three pixels of R, G and B, i.e., pl, p2, and p3 of a unit pixel p, allowing the conventional panel to display only 256 gradations of (0,0,0), (1,1,1) to (255,255,255) with 8-bit display. The present invention however is capable of controlling the color display device to represent the monochromatic image with additional gradations such as (0, 1, 0) , (1, 1, 0) between (0, 0, 0) and (1, 1,1) , for example, to thereby increase the number of display gradations and thus to allow displaying a high-definition image. This feature of the present invention to increase the gradation resolution is not disclosed by Fujii at all, as the Examiner acknowledges.

However the Examiner alleges that Kaise makes up for the deficiencies of Fujii. That is, the Examiner alleges that Kaise teaches micro-lenses that are fixed to monochrome liquid crystal panels arranged in corresponding optical paths of B, R and G light so that a higher luminance can be achieved. *See pages 2 and 3 of Office Action.* Even if, *assuming arguendo,* Kaise desires to achieve high luminance, nowhere does Kaise even mention displaying a monochromatic image having a higher gradation resolution than reproduction performance of each of the R, G and B

cells in said color display device. That is, Kaise never mentions higher gradation resolution with respect to reproduction performance.

However, the present invention is not intended to increase the gradation resolution by achieving a higher luminance, but rather, is capable of increasing the gradation resolution without increasing the maximum representation luminance, that is, without changing the maximum representation luminance of the display apparatus.

Further, Applicant submits that one skilled in the art would not combine Fujii and Kaise. Fuji relates to a specialized display where separation of images (one perceived by left eye, one perceived by right eye) creates a 3D display effect. In this connection, the 3D image is most effectively viewed by observation at multiple angles. Applicant submits that by contrast, the lenses of Kaise prevent divergence of light, thereby potentially narrowing the observed angle for parallax.

In addition, Fujii suggests that lens arrangements are costly and reduce yield, thereby teaching away from its combination with Kaise.

Finally, Applicant submits that one skilled in the art would NOT have been motivated to combine Fujii with Kaise at least because Fujii is directed to a three dimensional display device, while the invention of Kaise is not discussed with respect to three dimensional display devices. Therefore, even if, *assuming arguendo*, one would want to improve the resolution of the Fujii invention, one would not combine Kaise therewith to achieve this objective.

Applicant submits that dependent claims 2, 17, and 19 are patentable at least by virtue of their dependency from independent claim 1.

Further, with respect to dependent claim 19, nowhere do either of the applied references, alone or in combination, even discuss the luminance values that are displayed with a unit pixel, as they compare with those of each of R, B, and B cells.

Therefore, at least based on the foregoing, Applicant submits that claims 1, 2, 17, and 19 are patentable over the applied references, either alone or in combination.

§ 103(a) Rejections(Fujii / Kaise / Popovich) - Claims 3-16, 18, 20, and 23

Claims 3-16, 18 and 20-23 are rejected for the reasons set forth on pages 3-5 of the present Office Action.

With respect to independent claim 10, Applicant submits that this claim is patentable at least for some of the reasons set forth above with respect to claim 1. For example, Applicant submits that the applied references, either alone or in combination, do not teach or suggest at least that a monochromatic image is to be displayed on the color display device, as described in claim 10. Popovich does not make up for the deficiencies of Fujii. Furthermore, the Examiner does not identify, and none of the applied references illustrate, components that correspond to the claimed "a data allotting unit by which input data of a monochromatic image to be displayed on said color display device is allotted to R, G and B data for the R, G and B cells, respectively" and "processing unit by which the R, G and B data of monochromatic image obtained by allotment by said data allotting unit is output to the R, G and B cells for display on said color display device".

With respect to dependent claims 3-9, 11-16, 18, 20, and 23, Applicant submits that these claims are patentable at least by virtue of their indirect or direct dependencies from independent claims 1 and 10. Popovich does not make up for the deficiencies of Fujii and Kaise.

Further, with respect to dependent claim 4, the Examiner alleges that Popovich satisfies the limitations recited in claim 4. However, nowhere in col. 26, lines 60-76, cited by the Examiner, or in the corresponding figures, is there mention of minimum and maximum luminance values. Therefore, at least based on these reasons, Applicant submits that claim 4 is patentable over the applied references.

Further, with respect to claim 5, Applicant submits that the Examiner does not even mention the specific limitations of claim 5, and the applied references do not satisfy these limitations. Accordingly, Applicant submits that none of the applied references, either alone or in combination, teaches or suggests at least "wherein the maximum value of said input data is converted to a sum of values for R, G and B cells and used as a new set of input data," as recited in claim 5.

Further, with respect to claims 11 and 12, Applicant submits that claims 11 and 12 are patentable at least for reasons similar to those set forth above with respect to claims 4 and 5, respectively.

Further, with respect to dependent claims 6 and 13, Applicant submits that even if, *assuming arguendo*, Popovich teaches the use of image display control circuits (326) to control the sequential presentation of the monochrome images on the display screen, and discloses an optical filter control circuit (328) for controlling the color output of the optical filter (322), nowhere does Popovich mention that data for each of the R, G, B cells in the input data has been obtained by generally equal allotment, as described in claims 6 and 13. That is, controlling sequential presentation of monochrome images does not necessarily result in the features described in claims 6 and 13.

Further, with respect to claims 7, 8, 14, 15, 22, and 23, to support the rejections of claims 7, 8, 14, 15, 22, and 23, the Examiner alleges:

> Popovich teaches an image in the form of computer graphics, and discloses that an object with three -dimensional coordinates is expressed in through calculation by a computer in two dimensional image data (col. 10, lines 43-52). Popovich illustrates as shown in Fig 7A an image data corresponding to red, green and blue color images (col. 10, lines 60-67) in terms of denoted subscripts and coefficient expressions (col. 10, lines 60-67, col. 11, lines 5-37, Fig. 3 and Fig 7). Regarding claims 9-10, 16 and 19-20, Popovich teaches control circuits (326, 328) communicating with each other such that each of the displayed monochrome images is timely illuminated with the appropriate bandwidth light produced by the optical filter (324). See col. 20, lines 1-9 and Figs 18a-18c.

Nowhere, however, does Popovich disclose the particular limitations recited in each of claims 7, 8, 14, 15, 22, and 23. That is, for example, nowhere does Popovich even mention a CIE chromaticity diagram, nor does Popovich mention the other claim limitations. Moreover, the Examiner does not even discuss the particular claim limitations.

Further, with respect to claims 19 and 20, Applicant submits that the Examiner does not even discuss the limitations of these claims, and that none of the applied references teaches or suggests the claimed limitations.

Further, with respect to claim 21, Applicant submits that the Examiner did not identify and none of the applied references, including Popovich, discloses the components of the processing unit set forth in claim 21.

Finally, Applicant also submits that one skilled in the art would NOT have been motivated to combine Popovich with either of the other two references at least because Fujii and Kaise are related to LCDs, while Popovich does not even mention LCD technology therein.

Therefore, at least based on the foregoing, Applicant submits that claims 3-16, 18, and 20-23 are patentably distinguishable over the applied references, either alone or in combination.

In view of above-mentioned comments, any one skilled in the art would have never achieved the present invention to display a high-definition image of a monochromatic image such as a medical image on an ordinary color liquid-crystal panel with color filters by increasing the number of display gradations, even if he or she had combined the disclosures of Fujii and Kaise.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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